

REMARKS

Applicants have amended the claims previously considered by the Examiner in the above-identified application, in order to further clarify the definition of various aspects of the present invention. Specifically, claim 1 has been amended to recite that each projection is inserted into a respective corresponding groove; claims 9 and 33 have been similarly amended. Claim 9 has been further amended to recite that where the projection is provided for the two face plates of the first hollow shape member, the projection extends beyond an end of the end portion of the first hollow shape member (this end portion having been previously defined as being a portion abutted against an end portion of the second hollow shape member); and to recite that where the second hollow shape member is provided with the projection, the projection extends beyond an end of the end portion of the second hollow shape member. Each of claims 33 and 36 has been amended to recite that the plates are plates respectively of first and second hollow shape members; and to recite that the projection extends beyond an end of the end portion of the first plate of the specified hollow shape member. Dependent claims have been amended in light of amendments to the independent claims.

In addition, Applicants are adding new claims 41 and 42 to the application. Claim 41, dependent on claim 9, recites that an abutting face plate of the hollow shape members has a recessed portion, with this recessed portion opening outward toward both the width and thickness directions of the abutting face plate having this recessed portion, and wherein a projection or groove of the abutting face plate having the recessed portion, is provided within the recessed portion. Claim 42, dependent on claim 1, recites that the face plates of the second hollow shape

member are provided with the projections, with the projections extending beyond the end of the end portions of the face plates of the second hollow shape member, provided with the projections.

Applicants respectfully traverse the provisional rejection of various of their claims under the judicially created doctrine of obviousness-type double patenting, over claims 1, 2, 4, 8 and 9 of copending Application No. 10/600,614. As will be shown in the following, it is respectfully submitted that the applied claims of No. 10/600,614 as relied on by the Examiner define a separate patentable invention from the subject matter of the provisionally rejected claims, and that the subject matter of the applied claims would have neither taught nor would have suggested the subject matter of the provisionally rejected claims, such that the obviousness-type double patenting rejection is in error.

The present claims being provisionally rejected include independent claims 1 and 9. Independent claim 1 defines a friction stir welding method, in which specific hollow shape members are abutted and subjected to friction stir welding. Claim 1 recites that the hollow shape members include a first hollow shape member having, inter alia, recessed portions formed respectively to connecting portions where the two face plates of the first hollow shape member are each connected with a second connecting plate, each recessed portion opening outward toward both the width direction and the thickness direction of the hollow shape member, and with a groove or projection formed to one recessed portion and to the other recessed portion; and wherein the second hollow shape member includes, inter alia, a projection or groove formed to one face plate at the end portion of the second hollow shape member and a projection or groove formed to the other face plate of the end portion of the second

hollow shape member, and wherein each projection is inserted into a respective corresponding groove. That is, claim 1, and all claims dependent thereon, recite structure having the recessed portion, and the grooves and projections.

Present claim 9 recites an abutting step, and a step of performing friction stir welding, using specific hollow shape members. The recited first hollow shape member includes two face plates each having a groove opening toward the width direction or a projection protruding toward the width direction, with the projection extending beyond an end of the end portion of the first hollow shape member; and the second hollow shape member has two face plates each having either a projection protruding toward the width direction or a groove opening toward the width direction, with the projection extending beyond an end of the end portion, and with each projection being inserted into a respective corresponding groove. Thus, claim 9 recites structure having projections and respective grooves.

In contrast, claims 1, 2, 4, 8 and 9 of No. 10/600,614 are directed to a friction stir welding method for welding first and second members having specific structure, including arranging a recessed portion and opening this recessed portion directed toward an outer side of a thickness direction of the first member and toward the end portion of the first member, and overlapping an end portion of the second member to the recessed portion.

It is respectfully submitted that the subject matter claimed in claims 1, 2, 4, 8 and 9 of No. 10/600,614 would have neither disclosed nor would have suggested the presently claimed subject matter, including, inter alia, the grooves and/or projections, particularly together with the recessed portion, and advantages thereof.

The contention by the Examiner that the method of the provisionally rejected claims is taught in No. 10/600,614 "without the statement of insertion within a diameter range or range of depth of the recess" is respectfully traversed. As can be seen, for example, in Fig. 7 of No. 10/600,614, this patent does not disclose, nor would have suggested, the projections, much less the projections and grooves, and more specifically the projections, grooves and recesses, of the present claims, and advantages thereof.

The contention by the Examiner in the first full paragraph on page 3 of the Office Action mailed December 3, 2003, that the terminology is different between the present claims and in No. 10/600,614, is noted. It is respectfully submitted, however, that the terminology defines different structure; that is, each of No. 10/600,614 and the above-identified application includes recesses; however, it is respectfully submitted that No. 10/600,614 would have neither disclosed nor would have suggested structure as in the provisionally rejected claims, having not only recesses, but also the projections and grooves, as in claim 1 and claims dependent thereon; or having the projections and grooves, as in claim 9 and claims dependent thereon, with each projection inserted into a respective corresponding groove, as in claims 1 and 9 and claims dependent thereon.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the references applied by the Examiner in rejecting claims in the Office Action mailed December 3, 2003, that is, the teachings of the U.S. Patents to Rosen, et al.,

No. 6,045,027, to Ezumi, et al., No. 6,582,831, to Aota, et al., No. 6,050,474, to Kawasaki, et al., No. 6,321,975, to Nakamura, et al., No. 6,413,610, and to Ezumi, et al., No. 6,193,137, under the provisions of 35 USC §102 and 35 USC §103.

Initially, attention is respectfully directed to the rejection set forth in Item 7 on page 7 of the Office Action mailed December 3, 2003. This rejection references "Ezumi et al. (USPN 6,050,474)". However, U.S. Patent No. 6,050,474 is a patent of Aota, et al., as referenced in Item 5 on pages 5 and 6 of the Office Action mailed December 3, 2003. Moreover, the reference characters and columns/lines in the second paragraph of Item 7 on page 7 of the Office Action mailed December 3, 2003, correspond to those in No. 6,050,474 to Aota, et al. It is noted that there are many common claims, but not total correspondence, between the claims rejected in Item 5 on pages 5 and 6, and the rejection of claims in Item 7 on page 7, of the Office Action mailed December 3, 2003. In view of the confusion from the Office Action mailed December 3, 2003, the undersigned respectfully requests that the Examiner clarify the reference being applied in Item 7 on page 7 of this Office Action mailed December 3, 2003, if the rejection therein is maintained. To facilitate proceedings, and again noting the correspondence between the reference characters and columns/lines used in the second paragraph of Item 7 on page 7 of the Office Action mailed December 3, 2003, and in U.S. Patent No. 6,050,474, in the following discussion concerning the rejection in Item 7 the discussion would be in connection with U.S. Patent No. 6,050,474 to Aota, et al.

For the rejections set forth in Items 3-9 on pages 4-9 of the Office Action mailed December 3, 2003, it is respectfully submitted that these references as applied by the Examiner would have neither disclosed nor would have suggested

such a friction stir welding method as in the present claims, including the abutting and disposing (thereby friction stir welding) steps, and wherein the method includes use of first and second hollow shape members which are friction stir welded, the first hollow shape member including, inter alia, recessed portions formed respectively to connecting portions where two face plates of the first hollow shape member are each connected with a second connecting plate, each recessed portion being outward toward both the width direction and the thickness direction of the hollow shape member, a groove or projection formed to one recessed portion and a groove or projection formed to the other recessed portion; and wherein the second hollow shape member includes, inter alia, a projection or groove formed to one face plate at the end portion of the second hollow shape member, with a projection or groove formed to the other face plate at the end portion of the second hollow shape member, and wherein each projection is inserted into a respective corresponding groove when the first and second hollow shape members are abutted against each other. See claim 1; note also claims 34, 37 and 41.

That is, it is respectfully submitted that these references would have neither taught nor would have suggested friction stir welding two hollow shape members having, inter alia, recessed portions and projections and groove portions, with each projection inserted into a respective corresponding groove when the hollow shape members to be friction stir welded are abutted against each other.

Furthermore, it is respectfully submitted that these references would have neither taught nor would have suggested such a friction stir welding method, having abutting and performing friction stir welding steps for first and second hollow shape members, with the first hollow shape member including, inter alia, either a groove

opening toward the width direction or a projection protruding toward the width direction, formed at one width-direction-end of the first hollow shape member, with the projection extending beyond an end of the end portion of the first hollow shape member, and wherein the second hollow shape member includes, inter alia, a projection protruding toward the width direction or a groove opening toward the width direction, formed at one width-direction-end of the second hollow shape member, with the projection extending beyond an end of the end portion of the second hollow shape member, and with each projection being inserted into a respective corresponding groove when the two hollow shape members are abutted against each other. See claim 9; see also claim 41, with respect to positioning of the projection beyond an end of the end portion of the, e.g., respective plate of the hollow shape member.

Furthermore, it is respectfully submitted that these applied references would have neither disclosed nor would have suggested such a friction stir welding method as in the present claims, including steps of abutting end portions of first plates of each of two hollow shape members against each other, the first plate of the first hollow shape member including one end having a recessed portion opened outward toward both the width and the thickness direction of the first plate of the first hollow shape member and the first plate of the second hollow shape member including one end having a projection protruding outward to the width direction of the first plate of the second hollow shape member, this projection extending beyond the end portion of this first plate of the second hollow shape member, with the projection of the first plate of the second hollow shape member being inserted into the recessed portion of

the first plate of the first hollow shape member when performing the abutting. See claim 33.

That is, it is respectfully submitted that the applied references do not disclose, nor would have suggested, use of the hollow shape members as used in claim 33, including the one plate having the recessed portion and the one plate having the projection, with the projection being provided in the recessed portion.

Moreover, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such a friction stir welding method as in the present claims, including the steps of abutting and of disposing a rotary tool so as to perform friction stir welding, and wherein the structure being friction stir welded includes first and second hollow shape members, with the first plate of the first hollow shape member including one end having a groove portion opening outward toward the width direction of the first plate of the first hollow shape member, and the first plate of the second hollow shape member including one end having a projection protruding outward in the width direction of the first plate of the second hollow shape member, beyond the end portion of this first plate of the second hollow shape member. See claim 36.

Furthermore, it is respectfully submitted that these references would have neither taught nor would have suggested such method as in the present claims, having features as discussed previously, and, moreover, wherein the rotary tool is disposed so as to perform friction stir welding by inserting the rotary tool at the abutting end portions, the rotary tool being inserted such that a small diameter portion of the rotary tool extends beyond a bottom surface of the recessed portion (see claim 33).

In addition, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such a friction stir welding method as in the present claims, having features as discussed previously in connection with the independent claims, and, moreover, wherein the friction stir welding is performed to weld the abutted region, and the grooves and the projections (see claim 2); and/or wherein the recessed portion and projection are disposed within the range of diameter of a small-diameter portion of the rotary tool being inserted into the plates upon performing the friction stir welding (see claim 5) or wherein the central axis of the rotary tool is disposed within the range of depth of the recessed portion upon performing the friction stir welding (see claim 6); and/or wherein the groove and projection are disposed within a range of diameter of a small-diameter portion of a rotary tool inserted to the hollow shape members upon performing the friction stir welding (see claim 10); and/or wherein the central axis of the rotary tool is disposed within a range of depth of the groove upon performing the friction stir welding (see claims 11 and 12); and/or wherein end surfaces of the face plates are disposed substantially on an extension of the center line of the thickness of the second connecting plate in the abutting step (see claim 27); and/or disposition of the rotary tool in the step of disposing the rotary tool, as in claims 29-32.

Furthermore, it is respectfully submitted that the teachings of these applied references would have neither disclosed nor would have suggested the additional features of the present invention as in the other dependent claims, including (but limited to) wherein the groove and projection have trapezoidal shapes (see claims 35 and 40); and/or wherein only one of the two adjacent plates have a recessed portion, the other plate (of the two adjacent plates of respective first and second hollow

shape members) being positioned in the recessed portion during the abutting; and/or wherein the rotary tool is inserted to a depth beyond a depth of the lower surface of the recessed portion during insertion of the rotary tool (see claim 29).

The invention as presently claimed in the above-identified application is directed to a friction stir welding method for friction stir welding hollow shape members, which method can provide a good friction stir weld for adjacent hollow shape members, without deformation of the members being welded during the friction stir welding, while avoiding unduly adding weight to the structure formed due to a disadvantageously large number of supporting ribs. According to the present invention, movement of the members being welded in the thickness direction of the members can be at least suppressed, notwithstanding softening of the members by the frictional heat generated by the friction stir welding. In particular, according to the present invention, having the projections, and the grooves and/or recesses, particularly where such projections are inserted into the grooves of the adjacent member, the aforementioned deformation can be avoided. According to the present method, less work is required to cut off any uneven bumps formed after the friction stir welding at the joint region. Accordingly, the present invention achieves a relatively low cost. Moreover, it is possible to omit in advance a connecting plate disposed on the end region of both hollow shape members, orthogonal to the face plates; and, thus, a lightweight structure can be manufactured. Note, for example, the paragraph bridging pages 14 and 15, and the first full paragraph on page 15, of Applicants' specification.

It is emphasized that according to features of the present invention, projections extending beyond the end of the end portions of one of the two plate

members is used, in order to avoid the deformation. As will be shown in the following, it is respectfully submitted that the teachings of the prior art would not have disclosed, nor would have suggested, in friction stir welding of hollow shape members, use of such projections, much less use of such projections in combination with the recesses and/or grooves, as in the present invention, and advantages achieved due to use of such structure of the hollow shape members in the recited friction stir welding method.

Rosen et al., discloses a joint weld design and a method for holding together interface edges of workpieces to be welded. According to the disclosed technique, generally N-shaped interface edges that are complementary with each other on first and second workpieces are provided, the edges are mated, a force normal to the mated interfaces is applied, and a friction stir weld is formed along the mated interfaces. See column 2, lines 30-36. Note also column 3, lines 11-14, 18-26 and 41-47.

As can be seen, for example, in Figs. 2A-2C and 3A-3C, Rosen, et al. describes friction stir welding of solid workpieces. It is respectfully submitted that this reference does not disclose, nor would have suggested, the method according to the present invention, including use of the hollow shape members, much less where such hollow shape members have the specified projection, and recesses and/or grooves, as in the present claims, and advantages thereof.

U.S. Patent No. 6,582,831 discloses a friction stir welding method, in which one face plate of a frame member is welded using a connection member, by using a technique in which a projection at one end of the connection member is inserted into a groove in the frame member so that a proper positioning of the connection member

is achieved. See column 1, lines 62-67. Note also column 2, lines 10-25; column 4, lines 15-24; and column 6, lines 45, 46 and 56-65.

It is emphasized that No. 6,582,831 discloses a method using a connection member 30. Moreover, it is the connection member that has projection 34. It is respectfully submitted that the teachings of No. 6,582,831 would have neither disclosed nor would have suggested the presently claimed method, including use of the first and second hollow shape members having the specified structure (including projections). Again, it is emphasized that No. 6,582,831 requires additional structure of the connection member, and additional complexities in connection therewith.

The contention by the Examiner that No. 6,582,831 discloses abutting end portions of the first plate (11) against an end portion of a second plate (31) is noted. However, the claims as presently amended recite use of hollow shape members having plates with specified structure; even as interpreted by the Examiner, No. 6,582,831, having the connection member 30 with projection 34, would have neither taught nor would have suggested the presently claimed method.

No. 6,050,474 discloses a friction stir welding method wherein at least one of the members to be joined has a thickened part (that is, a part having a greater thickness in the thickness direction), in cross section, at the joining region thereof with another member, the thickened part protruding toward the rotary body used to perform the friction stir welding. The members to be joined are positioned adjacent each other, with the thickened part of one member being positioned adjacent the other member to be joined thereto by welding. Note the paragraph bridging columns 2 and 3 of this patent. See also Fig. 1 and the description in connection therewith in column 4, lines 35-55. Note also, for example, column 6, lines 21-25.

It is respectfully submitted that No. 6,050,474 would have neither disclosed nor would have suggested use of hollow shape members having the projection extending as in the present claims, much less such projection and recesses and/or grooves.

The contention by the Examiner that Aota, et al. discloses "projections" 66, 66a, is respectfully traversed, particularly insofar as applicable to the present claims. That is, various of the present claims recite projections extending beyond the end of the end portion of the respective plate, which would have neither been disclosed nor would have been suggested by Aota, et al., including structure represented by reference characters 66, 66a which constitute the end portions of the face plates.

Moreover, it is respectfully submitted that No. 6,050,474 would have neither taught nor would have suggested use of the hollow shape members including grooves, as in the present claims. In this regard, the Examiner contends that No. 6,050,474 discloses projections 66, 66a inserted into corresponding grooves 56a; the Examiner also refers to the structure shown by reference character 56a as being the "recessed portions". It is respectfully submitted that the Examiner has, improperly, designated the same structure of Aota, et al. to meet different recitations of the present claims; and that properly construing Aota, et al., this reference does not disclose, nor would have suggested, use of a hollow shape member having grooves and projections, much less having projections, together with recesses and grooves.

In connection with the rejections set forth in Item 7 on page 7 of the Office Action mailed December 3, 2003, it is respectfully submitted that the applied reference does not disclose, nor would have suggested, such hollow shape

members used in the presently claimed method, including projections and grooves, or projections and recessed portions, or projections and recessed portions and grooves. Applicants respectfully traverse the contention by the Examiner that the structure represented by reference characters 66 and 66a in No. 6,050,474 qualify as projections, insofar as projections are defined in the present claims, or that the structure represented by reference character 56a qualifies as grooves, particularly in light of the fact that the Examiner is relying on the structure represented by reference character 56a both as grooves and as recessed portions, which is improper under 35 USC §102 and/or 35 USC §103.

No. 6,193,137 discloses a friction stir welding method, and describes a structure having a V-shaped projecting portion at an end portion of one of the hollow members, with a recessed portion into which the projecting portion may enter being provided at another of the hollow members. See column 3, lines 8-12. Note also Fig. 7 and the corresponding description at, e.g., column 7, lines 14-24 and 5-64. See also Fig. 21 and the description in connection therewith at column 7, lines 50-64.

Note that each of Figs. 7 and 21 show solid members, with projections/grooves at a central location in the thickness direction of the solid members. It is respectfully submitted that this reference would have neither disclosed nor would have suggested the hollow shape member having the projections, and grooves or recesses, much less having the projections, grooves and recesses, as in the present claims, and advantages thereof.

Reference by the Examiner to Fig. 7 of No. 6,193,137 is noted; Fig. 7 shows a solid member, not a hollow shape structure. Moreover, it is respectfully submitted

that in connection with No. 6,193,137, the Examiner has improperly designated the structure represented by reference character 121 for being both recessed portions and grooves; and that, properly interpreted, No. 6,193,137 would have neither taught nor would have suggested the presently claimed structure, having the projections, and having the recessed portions and/or grooves, and advantages thereof.

It is to be noted that the Examiner relies on reference character 117 of No. 6,193,137 as being the projection. However, this structure represented by reference character 117 in No. 6,193,137 forms the recesses, and does not provide projections as in the present claims. If the structure represented by reference character 117 provides the recess, it is respectfully submitted that the Examiner may not properly rely on this as being "projections" as in the present claims.

No. 6,321,975 discloses a manufacturing method of a structure body according to a friction stir joining method, wherein a hole is provided on a member to be subjected to the joining, this hole being positioned at the position where the friction stir welding starts; and after the rotary tool is inserted to this hole, movement of the rotary tool along the welding line starts. See column 2, lines 7-12. Note also the paragraph bridging columns 2 and 3, and the first full paragraph in column 3, of this patent. Specifically, referring to Fig. 1, this patent discloses projection chips 36 forming a seat which supports the insertion force of a rotary tool.

It is respectfully submitted that No. 6,321,975 would have neither disclosed nor would have suggested the presently claimed method, including the hollow shape members having grooves, much less the recessed portions, and with the grooves and/or recessed portions being provided along with projections as in the present claims. In this regard, it is noted that in No. 6,321,975 the projections 36 extend

from support plate 34, and it is respectfully submitted that these projections are not projections beyond the end of the end portions of the specified plates, as in the present claims.

No. 6,413,610 discloses a manufacturing method of a structure body, set forth most generally in the paragraph bridging columns 2 and 3 of this patent. Note also the last paragraph in column 4; column 5, lines 10-25 and 34-36; column 6, lines 17-34; and the paragraph bridging columns 6 and 7. It is respectfully submitted that this reference does not disclose, nor would have suggested, a method using hollow shape members with the recited projections, as in the present claims, much less such projections together with recesses and/or grooves, and advantages of the structure in providing stable structure for friction stir welding.

The contention by the Examiner that No. 6,413,610 discloses members having grooves and projections which are interlocked when the members are placed in abutment, the Examiner referring the column 4, lines 56-67, is respectfully traversed. Column 4, lines 56-67, together with Figs. 1 and 2, show the structure having abutted faces 15b and 26b of the raised portions 15 and 25. See column 5, lines 58-65. It is respectfully submitted that this disclosed structure in Fig. 1, showing a seat for the raised portions, would have neither disclosed nor would have suggested the projections, much less the projections together with the recesses and/or grooves, and advantages thereof.

Moreover, where the references teach that the projections form the base of the recess portions, such teaching would not have taught, nor would have suggested, structure wherein the projection is inserted into the respective groove, or is inserted into the recess. See claims 1, 9, 33 and 36.

In addition, it is respectfully submitted that the teachings of the applied prior art would have neither disclosed nor would have suggested the other features of the present invention as discussed in the foregoing, and advantages thereof.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently in the application are respectfully requested.

To the extent necessary, Applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to the Deposit Account No. 01-2135 (Case No. 648.41111X00), and please credit any excess fees to such Deposit Account.

Respectfully submitted,

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